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Classification of Carp-Like Fishes.

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In attempting to classify the carp-like fishes (Eventognathi or Cyprinoidae) it is generally assumed that the suckers (Catostomidae) are the most primitive group. This is thoroughly in accord with the writer's views and he surmises that it is among ancestral bottom-feeding suckers that these fishes lost oral dentition, the lack of which is an outstanding feature with them all. Suckers are closely related to the true carps (Cyprinidae), but their recognition as a full family is at least convenient in this case. The comparatively few genera of suckers need no further subdivision. It may be noted that the northern genus *Catostomus* represents generalized or standardized forms, and that the single peculiar genus *Myxocyprinus* in China resembles one of the specialized genera in the lower Mississippi Valley. These peculiar suckers also have characters which are perhaps ancestral; and it may be questioned whether resemblance between Chinese and American genera is relationship or parallelism, whether these are specializations of more standard northern suckers or of some different ancestral forms.

More different in the main from the true carps are the loaches, a large varied group with characters generally spoken of as degenerate. It is the writer's view that the loaches are a recent specialization from the carps, perhaps more or less polyphylatic, but this may not be generally accepted. Classification of the loaches is very difficult. Two families are usually recognized, true loaches (Cobitidae), and flattened bottom forms (Homalopteridae). In the latter a series from *Crossostoma* to *Gastromyzon* is rather clear, its relationship to the others of which *Lepturichthys* seems to be a terminal specialization, obscure. It is probably impossible to divide the loaches on the basis of structural resemblances without violating relationships. To place the emphasis on apparent relationships the writer would recognize a single family for them (Cobitidae), consider the obvious groups or series central for four subfamilies, and tentatively place aberrant forms wherever they seem to fit least badly.

Cobitis and related genera (Cobitinae) are more or less elongate with erectile spine under the eye, a peculiar un-carp-like specialization. As their ancestors must have been without it we have some justification in considering *Misgurnus*, a widely distributed, abundant and somewhat aberrant eel-like genus which lacks the spine and otherwise resembles *Cobitis* in various ways, a primitive member of this series. *Botia* and related genera might be secondarily free-swimming standardized forms derived from *Cobitis*.

Nemacheilus, *Barbatula* and related genera lacking the erectile spine may be grouped in a subfamily (Nemacheilinae) very abundant in High Asia, also with a claim, which we do not recognize, to the genus *Misgurnus*.

The aberrant carp-like genus *Gobiobotia*, for lack of a better place, may go as a primitive Homalopterine; and the *Crossostoma-Gastromyzon* series stand as a subfamily (Gastromyzoninae).

The true carps are the most abundant family in this group, and represented by many genera. Their relationships to one another are sufficiently close and sufficiently confused to make their subdivision hardly worthwhile, but it is certainly a convenience. In so doing one may also give tangible expression to one's views on relationships. The carps are most differentiated in Asia; all the main groups are represented and most divergent there.

Weber and de Beaufort (Vol. III, 1916) recognize 3 subfamilies for Indo-Australian forms, Abramidinae, Rasborinae and Cyprininae, of which the last is the most composite. Turning to the list of species from China on the Asiatic continent we find various genera which fit into these subfamilies without much question, and others with northern affinities which do not. The keeled breams, *Megalobrama*, *Hemiculter*, *Erythroculter* and so forth obviously go into the Abramidinae, *Opsariichthys* which is related to *Rasbora* in the Rasborinae, *Cyprinus* and *Barbus* and their allies in the Cyprininae. One hesitates to place *Leuciscus* and *Phoxinus*, which with their allies are widely distributed northward, in the Rasborinae and may recognize a superficially somewhat parallel subfamily (Leuciscinae) for these. Though probably derived from this group *Schizothorax* and allied genera, abundant in High Asia, are sufficiently numerous and distinct to recognize as another subfamily (Schizothoracinae). The peculiar transverse mouth of the abundant Chinese genus *Xenocypris* is presumably derived from a more or less sucking mouth of bottom feeding forms, and this is perhaps the secondarily actively free swimming terminal member of a series (Chondrostomatinae) that runs from *Labeo*, through *Varicorhinus* to it, with various aberrant side specializations. The little fishes belonging to *Rhodeus* and allied genera form a uniform well differentiated group (Rhodeinae). The whole series of genera allied to *Gobio*, showing gradation from standard free-swimming to specialized bottom forms, may conveniently be considered a subfamily (Gobioninae), perhaps the most recently evolved, now replacing in the Chinese center of specialization earlier Chondrostomatinae, just as these or some other bottom Cyprinids presumably replaced the Catostomidae.

The standardized Leuciscinae may be the oldest group. Native American carps belong to it, with the exception of *Notemigonus*, an Abramidin. The Abramidinae and Schizothoracinae seem to be specializations of the Leuciscinae. Whence the Rhodeinae came is uncertain but one may suspect from the Abramidinae. The Cyprininae are now flowering in southern Asia, and *Cyprinus* itself is possibly a relict from an earlier period of differentiation in this group. The Gobioninae may be derived from the Cyprininae.

There are plenty of Cyprinid genera, aberrant or otherwise, to be assigned to this or that of these eight divisions according to one's idea of their relationships, but these eight as outlined can be considered to cover the group in all parts of the world, and afford a basis for discussion of the relationships of any genus.

TENTATIVE SUBDIVISION OF THE CYPRINOIDEA.

Suborder Cyprinoidea. Carp-like fishes.

Family Catostomidae. Suckers.

Family Cyprinidae. True Carps.

- (1) Subfamily Leuciscinae—*Leuciscus*, *Phoxinus*, *Richardsonius*, *Hybopsis*, etc.

- (2) Subfamily Rasborinae — *Rasbora*, *Danio*, *Opsariichthys*, *Barilius*, etc.
- (3) Subfamily Abramidinae. *Abramis*, *Erythroculter*, *Hemiculter*, *Notemigonus*, etc.
- (4) Subfamily Schizothoracinae. *Schizothorax*, *Schizopygopsis*, *Diptychus*, etc.
- (5) Subfamily Rhodeinae. *Rhodeus*, *Pseudoperilampus*, *Acanthorhodeus*, etc.
- (6) Subfamily Cyprininae. *Cyprinus*, *Osteochilus*, *Barbus*, *Labeo*, etc.
- (7) Subfamily Chondrostomatinae. (*Labeo*), *Varicorhinus*, *Chondrostoma*, *Xenocypris*, etc.
- (8) Subfamily Gobioninae. *Gnathopogon*, *Gobio*, *Pseudogobio*, *Saurogobio*, etc.

Family Cobitidae. Loaches.

- (1) Subfamily Cobitinae. *Misgurnus*, *Cobitis*, *Botia*, etc.
- (2) Subfamily Nemacheilinae. (*Misgurnus*), *Nemacheilus*, *Barbatula*, etc.
- (3) Subfamily Homalopterinae. (*Gobiobotia*), *Homaloptera*, *Lep-turichthys*, etc.
- (4) Subfamily Gastromyzoninae. *Crossostoma*, *Hemimyzon*, *Gastromyzon*, etc.

Dr. Y. T. Chu has recently (1935, *Biol. Bull.* St. John's Univ., Shanghai, No. 2, p. ix) listed Chinese genera of Cyprinidae in eight subfamilies. He does not differentiate Rasborinae from Leuciscinae, and recognizes a subfamily for the aberrant genus *Hypophthalmichthys* of uncertain relationships. There are presumably other aberrant Cyprinid genera which might be so treated. He confines the Chondrostomatinae to genera close to *Xenocypris*, leaving less terminal ones in the Cyprininae, a more conservative procedure especially as the phylaticy of the series from *Labeo* to *Xenocypris* is assumed rather than proved. Also the name Acheilognathinae is used by him in place of Rhodeinae.